δesfa	Hellenic Gas Transmission System Operator S.A. 357-359 Messogion Av., GR 152 31 Halandri Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr		TECHNICAL SPECIFICATION	
Doc No: DSF-SPC-PIP-0	39	Rev. 1	Page 1 of 13	



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Table of Contents

SCO	OPE AND OBJECTIVES	. 4
1	REFERENCES	.4
2	ACRONYMS	. 5
3	INSPECTION	. 5
4	WELDING PROCEDURES AND WELDERS	. 6
5	PREPARATIONS FOR WELDING	.7
6	WELDING	10
7	IDENTIFICATION OF WELD SEAMS	12
8	WELD QUALITY CONTROL	12



SCOPE AND OBJECTIVES

This Specification covers welding of piping in natural gas and piping systems within Metering and Regulator Station including tie-in welds.

For the performance of welding, the requirements of the following shall be fulfilled:

- This Specification.
- Documents to which reference is made in the following.
- ELOT EN 1594
- ELOT EN 12732
- Job Spec. No. DSF-SPC-PIP-023

1 REFERENCES

1.1 Reference Documents

Job Spec. No. DSF-SPC-PIP-012 [Welding] Job Spec. No. DSF-SPC-PIP-023 [Welding Inspection of Piping M/R Stations]

1.2 Reference Codes and Standards

EN 1594

[Gas supply systems - Pipelines for maximum operating pressure over 16 bar - Functional requirements] EN 12732 [Gas supply systems - Welding steel pipework - Functional requirements] EN 9606-1 [Qualification testing of welders. Fusion welding. Steels] EN ISO 15614-1



[Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys]

EN ISO 3834-2

[Quality requirements for fusion welding of metallic materials — Part 2: Comprehensive quality requirements]

EN ISO 14731

[Welding coordination — Tasks and responsibilities]

2 ACRONYMS

WPS: Welding Procedure Specification

WPQR: Welding Procedure Qualification Record

DN: Nominal Diameter

3 INSPECTION

The welding work will be inspected by an Accredited Inspection Body appointed by the Owner. The inspection shall be carried out according to the specification Job Spec. No. DSF-SPC-PIP-023 "Welding Inspection of Piping for M/R Stations".

The Contractor shall provide all necessary personnel and equipment.

In preparing the schedule for the welding program, the Contractor shall include the necessary time for the welding inspection.

The Contractor shall supervise the site, the welders and their work during the entire working period. For this purpose, he shall use a foreman or an engineer, with adequate theoretical knowledge and practical experience in the performance and evaluation of the welding work. Depending on the project the OWNER may require certification in accordance to EN ISO 3834-2 and welding coordination personnel covering the requirements of EN ISO 14731.

The equipment shall, at least, include the following

- welding equipment and power supply, suitable for the procedure to be used.
- preheating equipment, which ensures uniform preheating around the whole circumference of the ends.
- Drying and preservation furnaces, to keep the electrodes dry at each site or workshop and at each welder's position.
- temperature sensitive crayons or other suitable equipment.
- line-up clamps.



- protective canopies.
- high temperature insulation mats for the thermal insulation.
- grinding machines,
- cutting machines.
- other equipment necessary to ensure a satisfactory quality of the welding work.

If personnel or equipment are replaced during the execution of the contract, an approval shall be obtained from the Owner's Representative.

4 WELDING PROCEDURES AND WELDERS

4.1 WELDER QUALIFICATION

At all times during welding work, all welders shall have a valid certificate, according to EN ISO 9606-1 applicable for the materials to be used and the welding procedure to be applied.

All the above-mentioned certificates shall be kept on site during the whole working period.

Welders without certificates or with expired certificates shall not perform any welding work at all.

Unqualified personnel shall not be allowed to perform production welding. Any welds performed by unqualified personnel shall be removed at Contractor's cost.

4.2 WELDING PROCEDURE QUALIFICATION TESTS

All welding procedures used shall be qualified in accordance with EN ISO 15614-1 level 2 and EN 12732. Test specimens from the welding procedures in question shall be available to the Owner.

Welding Procedure Qualification records older than two years' old shall require approval by the OWNER prior to their use in the project.

In general, only arc welding shall be used. Downhill welding or gas welding shall only be used if specially approved by the Owner or his Representative.

4.2.1 WELDING PROCEDURE SPECIFICATION

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Doc No : DSF-SPC-PIP-()39	Rev. 1	Page 7 of 13

The WPS shall cover details which are important to the production of sound welds. All essential and non-essential welding parameters mentioned in EN ISO 15609-1, EN ISO 15614-1 and EN 12732 shall be included in the WPS issued for the project.

The WPS information may be presented in any format, written or tabular, to fit the needs of each Manufacturer or Contractor as long as every essential and nonessential variable that is required for the correct application of the welding procedure is included.

Any WPS issued for use in the project shall be covered by a Welding Procedure Qualification Record. Any welding procedure that requires change in an essential welding parameter in accordance to EN ISO 15614-1 and EN 12732 shall require a new qualification test.

5 PREPARATIONS FOR WELDING

5.1 PREPARATION OF MATERIALS

All pipes shall be internally cleaned of any dirt, mill scale, rust, or other foreign matter.

Dents shall be removed by other suitable methods, following approval by the Owner's Representative.

5.2 WELD ENDS

All weld ends shall be cleaned mechanically with a wire brush or mechanical grinder. The cleaned area shall extent at least 10 mm from the end.

All burrs, serrations, notches, mill scale, rust and dirt shall be removed.

The ends shall be prepared by grinding to comply with the designs indicated in the applicable WPS.

Surface defects and weld end defects, which cannot be repaired, shall be removed by cutting away the damaged section, preferably with a cutting disc.

After the cutting operation, the pipe ends shall be beveled carefully.

Beveling by flame-cutting is not permitted. If smaller diameter girth welds are not accessible from the inside, a short section may be cut from the pipe to be connected and used as a cross-over and fitting (see **FIGURE 2** DESFA **Job Spec. DSF-SPC-PIP-012)**.

If the cutting operation is carried out with a flame cutter, the surfaces shall be ground to remove bums and burnt material from both inside and outside.

If the cutting out of defects cannot be performed without removing the marking on a pipe or fitting, the Contractor shall, before cutting, place a new set of marks on the remaining section, in the presence of the Owner's Representative. Material without proper traceability shall not be allowed for installation in the project. Contractor shall be charged for any rejected Owner material not used due to inadequate traceability procedures.

Weld-ends produced after cutting of pipes or bends shall be examined by the Contractor for the presence of laminations.

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Doc No: DSF-SPC-PIP-039		Rev. 1	Page 8 of 13	

Laminations shall be cut off as specified for surface and weld-end defects. Furthermore, each pipe or fitting shall be examined to discover any visible internal or external defects. Hereafter the Contractor is responsible for the usability of these items. Any defects shall be evaluated in consultation with the Owner's Representative.

5.3 LINNING UP

Immediately prior to lining up, the pipe shall be inspected to ensure that no damages have occurred during handling and storing of the pipe.

The welding of pipes, fittings, etc. on site shall, as far as possible, be performed outside the pipe- trench. Lining up and welding of pipe sections shall be carried out alongside the pipe-trench, the pipeline being placed min. 0.40 m above the ground level.

With longitudinally welded pipes, the seam shall, as far as possible, be placed in the upper quadrant of the pipe circumference (exceptions may be made with factory bends, tees, etc.). Longitudinal seams shall, at girth welds, be offset at least 100 mm from each other.

Branch-connections, weldolets, etc., shall never be connected to longitudinal or girth seams.

Weld seams for branch-connections shall be offset at least 100 mm from longitudinal and girth seams. Mitre joints are not permitted.

Line-up clamps shall be used for all girth welds.

Wherever possible internal clamps should be used.

Where it is necessary to use external clamps (tie-ins, installation of fittings, etc.) uphill welding shall be used.

The offset of the pipe ends may never exceed 1.6 mm for pipes with the same wall thickness.

Where offset is caused by the pipe's ovality, the pipe may be turned to reduce the offset. The width of the root gap shall be within the range dictated by the applicable WPS.

Joints which cannot be lined-up with either internal or external line-up clamps may be tackwelded. These tackwelds, however, shall be completely ground out before the root bead is completed.

Only those weld seams which are necessary to join pipes or install those auxiliary fittings that are specified in the construction plan, are permitted.

No temporary welds on the surface of the pipe are permitted.

Pipe-fittings, flanges, tees, bends etc. shall be supported during welding so that excessive stresses in the connected pipe are avoided.

5.4 MATERIAL IDENTIFICATION

The contractor shall verify that the quality and wall thickness of items to be welded together are in accordance with the project requirements and shall ensure that the marked

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Doc No : DSF-SPC-PIP-039)	Rev. 1	Page 9 of 13

operating pressure of fittings is in accordance with the operating pressure of the pipeline. All materials to be used shall be traceable to the relevant certificates which will be reviewed and endorsed by the OWNER appointed Inspector and/or Representative. Non traceable materials may not be used.

If, for construction purposes, a pipe has to be cut up into sections, new sets of marking shall, before cutting, be placed on the un-marked sections in the presence of the Owner's Representative.

5.5 TYPES OF WELDING ELECTRODES

The welding electrodes shall be approved by the Owner or his Representative before the procedure test.

The welding electrodes shall be stored by the contractor according to the manufacturer's instructions or after instructions from the Owner's Representative.

5.6 PREHEATING

If, in the WPS, no indication of preheating is given, the following requirements should be satisfied:

- At temperature below 0°C the weld-zone shall be preheated to approx. 80°C when laying the root bead and hot pass.
- At temperature between -5°C and -10°C permission of welding shall be obtained from the Owner's representative.
- At temperatures below, -10°C welding is not permitted.
- The weld-zone shall be kept free of condensation.
- When welding items of steel with a specified minimum yield strength (S.M.Y.S.) higher than L360, preheating shall always be used.

In these cases, the preheating temperature shall be between 80 - 150°C.

In case of bad weather conditions, all protective measures should be taken in order to protect the quality of welding. All these measures have to be in compliance with Owner's requirements. His written approval is also required.

If necessary, heated canopies may be used in cold weather conditions.

The preheated zone shall extend min. 100 mm to each side of the seam. If necessary, any coating must be cut back 150 mm. Only equipment giving an evenly distributed heat around the whole circumference may be used. Acetylene burners may not be used.

The temperature shall be controlled with temperature sensitive crayons or other equivalent means and the correct temperature shall be reached at the moment welding starts. Preheat requirements shall be satisfied during tack welding. Tack welds and root beads must be staggered 180°.



6 WELDING

6.1 GENERAL

Prior to welding, the opposite ends of the pipes shall be capped so that no draught occurs through the piping.

The striking of arcs outside the beveled ends is not permitted. Should arcs be struck outside this area, it shall be brought to the attention of the Owner's representative who may require any resulting damaged section to be repaired at the contractor's expense.

6.2 ROOT BEAD

For pipes with external diameter DN > 500 two welders shall weld at the same time on each side of the circumference.

The line-up clamps may not be removed until at least 70% of the root bead has been laid.

The root bead shall be ground down before making the hot pass and checked visually for defects.

All other beads shall be brushed before making the next pass, and checked visually for defects.

Hammers may not be used.

6.3 HOT PASS

This shall be made by at least two welders, working simultaneously, for pipe diameters DN > 500. It shall be ensured that the hot pass is done immediately after the root bead has been laid, and preferably by the same welders.

6.4 FILLER AND CAP BEADS

Filler and cap beads shall be laid in "one heat". If this condition is not satisfied, the Owner or his Representative may require the joints in question to be 100% ultrasonically tested at



the Contractor's expense. Each pass shall be completed around the whole circumference before the next pass is started.

The cap bead may not extend more than 1.6mm above the pipe surface.

On completion of the cap bead, the uncoated part of the pipe shall be cleaned from weld spatter and other deposits by brushing and shall, for outdoor welding, be wrapped with a dry high temperature insulation mat to ensure a slow cooling of the weld zone and protection against rain.

6.5 WELDING OF STRUCUTRAL ELEMENTS TO PIPELINE COMPONENTS

For these applications, a separate procedure test, and subsequent destructive testing, will be required and the corresponding WPS issued.

Structural elements shall as far as possible be welded with uninterrupted girth welds of at least two passes. If no preheat is given in the relevant WPS for welding of structural elements on pipes with a S.M.Y.S. higher than L360 a preheat up to 150°C shall be applied before start of welding.

6.6 WELDING OF FITTINGS, TEES, ETC.

The fittings shall be welded stress-free. Joints shall be made by girth welds. If the fitting material is not covered by the WPQR applicable for welding of the corresponding piping a new welding procedure qualification test shall be performed as required. Any limits of preheating temperature indicated on butt-welding ends shall be followed.

6.7 WELDING OF HALF SHELLS

For these applications a separate procedure test, and subsequent destructive testing, will be required.

6.8 BACKWELDING

For pipes with external diameter DN > 300 backwelding is permitted with internal offsets not exceeding 2.4 mm. Instead of backwelding, however, it is recommended to lay the root bead uphill from the inside and then to complete the seam from the outside. If the offset exceeds 2.4 mm, extra material shall be removed (see **FIGURE 1, Job Spec. No. DSF-SPC-PIP-012).** In these cases, or in cases of welding activities in confined spaces in general, special safety precautions shall be taken by the Contractor.



6.9 CLOSING OF PIPE ENDS

At interruptions in the pipe construction, the Contractor shall close the ends of the pipe sections with a plug or plastic cap. The closure shall be tight enough to prevent the entry of any foreign material or debris. Plugs or caps may not be fixed by welding or by any other method which damages the pipe. They shall be securely attached to the pipe and shall remain in place until the sections are connected.

7 IDENTIFICATION OF WELD SEAMS

Any girth weld shall be numbered by the Contractor according to a system which has been agreed with the Owner's Representative. This number shall be marked with permanent stencil on the pipe surface or the pipe coating to one side of the joint, together with pipe number and any other relevant identification, to facilitate completion of the pipe weld record.

Repair welds have to be marked with the same identification number and an index A, B or C according to repair sequence.

Tie-in seams shall be identified by their number.

The pipe record shall also identify the welders, who have made the root and hot pass (if different). The welder identification system shall be approved by the Owner's Representative and no identification number may be re-used.

For each pressure test section, the Contractor shall submit pipe welding log forms for review and approval by the Owner's Representative prior to commencement of the pressure test.

8 WELD QUALITY CONTROL

8.1 SUPERVISION AND TESTING

The Contractor has to supervise the welders and their work during the entire work period.

8.2 TEST EVALUATION

All welding testing and the relevant acceptance criteria shall be in accordance to Job Spec. No. DSF-SPC-PIP-023.



8.3 TEST REPAIR OF DEFECTS

Girth welds with defects may be repaired only once. A second repair on the same location is not permitted. All repair welding activities shall be covered by a corresponding WPQR. Defects in the seam shall be ground out before repair welding is commenced, and the

repair shall be made with uphill welding with electrodes of a suitable type.

The repair groove shall be examined by dye penetrant testing or by magnetic particle examination, to ensure complete removal of the defects.

The area to be repaired shall be preheated according to the requirements of the applicable WPS.

Weld seams with cracks shall be cut out, i.e. the entire seam shall be removed. Repair weld shall be carried out in accordance with the relevant approved repair welding procedure.

After the repair, the welds have to be re-tested.

All welds which have been repaired shall be classified "repair welds" in the pipe weld log record and be re-tested according to the specification Job Spec. No. DSF-SPC-PIP-023. Weld repair cost and costs for re-testing shall be paid by the Contractor.